REMARKS

Claim 1 has been amended based on the disclosure at, e.g., page 6, lines 23-25 in the present application.

Entry of the above amendment is respectfully requested.

Obviousness Rejections

Claims 1, 2, 5 and 9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Abe (JP 2002-050413, machine translation previously provided) in view of Granqvist et al. (US 20050238550) and Ohya et al. (US 6629833). Claims 1, 5, 8-9 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura (US 6291763) in view of Granqvist et al. (US 20050238550) and Ohya et al. (US 6629833). Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura (US 6291763) in view of Granqvist et al. (US 20050238550) and Ohya et al. (US 6629833) as applied to claim 1 above, and further in view of Tamai et al. (US 20020037399).

Applicants respectfully submit that the invention as recited in the amended claims is not obvious over the cited art combinations, and request reconsideration and withdrawal of these rejections in view of the following remarks.

The present invention

The present invention is characterized by at least the following:

(A) the transparent conductive layer having a surface tension of 40 mN/m or greater, and

(B) polyester film that has a light transmittance of no greater than 2% at a wavelength of 370 nm and a light transmittance of 70% or greater at 400 nm.

(1) Feature (A)

Concerning feature (A), the surface tension of a transparent conductive layer without activation of the surface is less than 40 mN/m, as shown in Comparative Example 3 in Table 2 in the present application.

Moreover, feature (A) of the present invention is not the surface of the polyester film but the surface of the transparent conductive layer.

The transparent conductive layer having the surface tension of 40 mN/m or greater can be achieved by a method of activation by plasma treatment or other treatments mentioned at page 10, line 18 - page 11, line 6 of the specification.

Additionally, Applicants submit that it is possible to provide a laminated film for a dye-sensitized solar cell and an electrode for a dye-sensitized solar cell which have excellent adhesion between the transparent conductive layer and the porous semiconductor layer by having feature (A).

(2) Feature (B)

With regard to feature (B) of the present invention, the present invention defines two kinds of light transmittance.

First is the feature of a light transmittance of no greater than 2% at a wavelength of 370 nm, which means the light transmittance at a wavelength of 370 nm needs to be quite low. The background of the first feature is that a metal oxide used in porous semiconductor layer is activated under the ultraviolet wavelength, so the metal oxide reduces the properties of polyester film and solar cells, etc., and then reduces a photogenerating efficiency with time after fabrication of the dye-sensitized solar cell (page 6, line 27 - page 7, line 2 of the specification).

Means to achieve the first feature depend on the kind of polyester. For example, in the case of PEN (polyethylene-2,6-naphthalate), PEN polymer absorbs the UV light by itself; also, containing an ultraviolet absorber is preferable (Example 8 relates to PEN film containing an ultraviolet absorber).

In the case of PET (polyethylene terephthalate), containing an ultraviolet absorber is required (Examples 7 and 9 relate to PET film containing an ultraviolet absorber vs. Reference Example 4, which relates to PET film without an ultraviolet absorber).

Applicants wish to emphasize the importance of the light transmittance property at the wavelength of 370 nm of polyester film as follows:

When the ultraviolet blocking effect is insufficient, a metal oxide such as titanium oxide used in a porous semiconductor is activated by photocatalytic function under the ultraviolet wavelength, and then the activated metal oxide deteriorates the property of the dye, which results in reduced photogenerating efficiency with time after fabrication of the dye-sensitized solar cell (see page 6, line 27 - page 7, line 2).

Applicants note that polyester films are also affected by ultraviolet light, but there is no necessity to block ultraviolet light until the wavelength at 370 nm when the object is simply to maintain the properties of polyester film.

The second feature of feature (B) is a light transmittance of 70% or greater at a wavelength of 400 nm, which means the light transmittance at a wavelength of 400 nm needs to be high.

The light transmittance of visible light affects photogeneration, so the light transmittance of the visible light wavelength is required to be 70% or greater. As the Examiner points out, polyester has the property by itself, although when polyester film contains excess ultraviolet

absorber, the light transmittance become lower (Reference Example 5 relates to PET film containing excess ultraviolet absorber, which satisfies the first feature but does not satisfy the second feature).

Transmittance at a wavelength of 400 nm is also important to obtain high photogenerating efficiency because the use of a shorter wavelength under the visible wavelength range increases photogenerating efficiency.

Therefore, both the light transmittance property of no greater than 2% at the specific wavelength at 370 nm and the light transmittance of 70% or greater at 400 nm have great significance, even though both wavelengths are very close.

Cited documents

(a) JP2002-050413 (Abe et al)

Abe at al discloses a laminate film for a dye-sensitized solar cell containing a polyester film (PET) and a transparent conductive layer (ITO).

Meanwhile, the surface tension of the transparent conductive layer disclosed in this document does not satisfy the feature (A), as shown in Comparative Example 3 in the present application (surface tension of the ITO transparent conductive layer without activation of the surface is 32.3 mN/m).

Also, Abe at al is silent as to improving an adhesion between the transparent conductive layer and the porous semiconductor layer.

Moreover, Abe at al is silent as to the light transmittance of no greater than 2% at a wavelength of 370 nm (the first feature of the feature (B)).

Abe at al also fails to disclose the difference in the heat shrinkage rates in the lengthwise direction and widthwise direction of the film upon heating for 10 minutes at 200°C.

(b) US 2005/0238550 (Granqvist et al)

The invention of this document is directed to a pollutant decomposition device. Granqvist teaches the device comprising at least one outer transparent sheet and at least one inner transparent sheet, further comprising a photocatalyst arranged between the sheets.

As the outer transparent sheet, Granqvist teaches the high degree of ultraviolet transmittance property to obtain maximum photocatalytic activity of the photocatalysts.

Meanwhile, Granqvist discloses a lower degree of ultraviolet transmittance of the inner transparent sheet compared with the outer transparent sheet for the purpose that the transmitted UV light would not degrade organic materials.

Granqvist discloses polyester film as an example of the inner transparent sheet, but is silent as to the specific wavelength in connection with the ultraviolet light and the specific light transmittance at the wavelength for the polyester film used as the inner transparent sheet.

Accordingly, *the technical idea of Granqvist's invention is to let the photocatalyst activate by transmitting UV light through the outer sheet having a high degree of ultraviolet transmittance, so concerning the technical idea, Granqvist teaches in the opposite direction from the present invention.*

(c) US 6629833 (Ohya et al)

The invention of this document relates to transparent conductive films using plastic films and to touch panels.

Ohya discloses a transparent conductive thin film having a surface tension of 35 to 60 dyne/cm.

On the other hand, Ohya's invention is mainly used in touch panels, so the objective of the surface tension property of the transparent conductive film is strong adhesion to silver paste

when used in touch panels. In contrast, the objective of the surface tension property of the transparent conductive layer in the present invention is excellent adhesion between the transparent conductive layer and the porous semiconductor layer.

Therefore, the kind of the adjacent material is different from the present invention.

Moreover, the silver paste is used in a trace amount, so the silver paste does not form a layer on the transparent conductive layer, but usually forms a portion on the transparent conductive layer as measured in the shape of mesh in the measurement of adhesion properties to silver paste (measurement (9)) in Ohya's invention.

Concerning the shape of the porous semiconductor in the present invention, which is laminated on the transparent conductive layer, the shape is a planar state, so the shape of the adjacent material is different.

(d) US 6291763 (Nakamura et al)

Nakamura at al discloses a laminate film for a dye-sensitized solar cell containing a polymer film including polyester layer and a transparent conductive layer.

Meanwhile, the surface tension of the transparent conductive layer disclosed in this document does not satisfy the feature (A), as shown in Comparative Example 3 of the present application (surface tension of the ITO transparent conductive layer without activation of the surface is 32.3 mN/m).

Also. Nakamura et at is silent as to improving an adhesion between the transparent conductive layer and the porous semiconductor layer.

Nakamura et at disclose only that an electrically conductive substrate is preferably substantially transparent to light, which means that the visible light (wavelength from 400 to 900 nm) transmission is preferably 70% or more (the second feature of the feature (B)).

Meanwhile, Nakamura et at fails to disclose the light transmittance of no greater than 3% at a wavelength of 370 nm (the first feature of the feature (B)).

Nakamura et al also fails to disclose the difference in the heat shrinkage rates in the lengthwise direction and widthwise direction of the film upon heating for 10 minutes at 200°C.

(e) US 2002/0037399 (Tamai et al)

Tamai at al discloses a laminate film containing a polyester film (PET) and a transparent conductive layer (ITO).

The surface tension of the transparent conductive layer disclosed in this document does not satisfy the feature (A), as shown in Comparative Example 3 of the present invention (surface tension of the ITO transparent conductive layer without activation of the surface is 32.3 mN/m).

Also, Tamai et al is silent as to improving an adhesion between the transparent conductive layer and the porous semiconductor layer.

Tamai et al disclose only that the conductive film is transparent, which means that visible light is transmitted by the layer (the second feature of the feature (B)). Meanwhile, Tamai et at fails to disclose the light transmittance of no greater than 3% at a wavelength of 370 nm (the first feature of the feature (B)).

Tamai et al also fails to disclose the difference in the heat shrinkage rates in the lengthwise direction and widthwise direction of the film upon heating for 10 minutes at 200°C.

Claim Rejections under § 103(a)

Concerning the surface tension property (feature (A)), the transparent conductive layer disclosed by Abe et al and Nakamura et al do not inherently have the specified surface tension (40 mN/m or greater) as described at the reference example 3 in the specification of the present invention.

The Examiner considers that it would have been obvious to a person of ordinary skill in the art to provide a surface tension of 35-60 dyne/cm to the transparent conductive film of Abe to provide a strong adhesion between the adjacent layers as taught by Ohya.

Contrary to the Examiner's position, though, the kinds of adjacent objects and their shape disclosed in Ohya differs from the present invention, so Applicants believe it is not obvious to one of ordinary skill in the art to find the specific surface tension of 40 mN/m or greater as the transparent conductive layer to obtain excellent adhesion between the transparent conductive layer and the porous semiconductor layer based on Abe in view of Ohya et al.

With regard to the light transmittance properties, Abe and Nakamura disclose light transmittance at 400 nm; however, Abe and Nakamura are silent as to the light transmittance of no greater than 2% at the wavelength of 370 nm.

The Examiner considers that a polyester film is degraded by UV-radiation and therefore the addition of a UV-absorber would enhance the stability of such a polyester film as taught by Granqvist, so it would have been obvious to a person of ordinary skill in the art to add a UV-absorber to the PET film of Abe as taught by Granqvist to limit the UV radiation transmitted by the film to prevent degradation, and further it would have been obvious to one of ordinary skill in the art to modify the amount of UV absorber present in the film to achieve the lowest UV transmittance possible.

However, Applicants submit that the Examiner is using hindsight referring Granqvist, because the technical idea of Granqvist's invention is to let the photocatalyst activate by transmitting UV light through the outer sheet having a high degree of ultraviolet transmittance, so concerning the technical idea, Granqvist teaches in the opposite direction from the present invention.

Moreover, even if it is possible to refer to Granqvist despite the opposite technical idea, Granqvist is silent as to the specific wavelength and the specific light transmittance at the wavelength.

The wavelength of 370 nm and the light transmittance of no greater than 2% at the wavelength is significant in the present invention for maintaining the photogenerating efficiency of the dye-sensitized solar cell even after the weather resistance acceleration test.

Therefore, Applicants submit that it would not have been obvious to achieve the light transmittance property at 370 nm over Abe in view of Granqvist at al.

Moreover, as the effect of the present invention, the photogenerating efficiency with time after fabrication of the dye-sensitized solar cell is improved (for instance, example 9 shows a photogenerating efficiency of 2.1% at the initial stage, and 2.0% after a weather resistance test (see page 39, line 3 to line 11)) when the laminated film satisfies these properties.

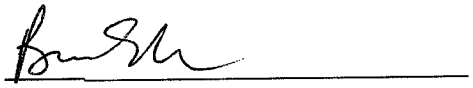
Accordingly, Applicants submit that the present invention is not obvious over the cited art combinations, and withdrawal of these rejections is respectfully requested.

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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Date: September 22, 2010